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Textile Accounting Series I.

THE SCIENTIFIC MANAGEMENT IN TEXTILE MILLS



By

Ratanlal Maganlal Atmaram Bhukhanvala

T.C.A. [Textile].

Textile Expert, Accountant & Process Auditor.

Author of Defecting Costing in Textile Mills,

Cloth & Yarn Costing, Colliery Costing

Bhukhanvala House,
Ambaji Road,
SURAT.

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INTRODUCTION

The aim of the present work is the explanation of the general principles on which scientific management of textile mills depend.

To explain why such and such a process is good and such and such other process is improper is the duty of a technical man. The duty of the textile economist is, so far as possible, to explain generally what has been made and will make management efficient and also, given certain systems and procedures, what has made and will make management healthy and give greater efficiency and a greater return.

With regard to the processes and applications of problem thereto, the generalisations of economics are universally true. They are independent of changes in machineries and its working. But with regard to its management and control the case is different. There are no laws regarding the determination of the processes in the mills. The causes which give productive efficiency vary.

The industrialist may attempt to explain the causes which determine the variations, they may explain the methods and lay down acute scientific principles to control the internal working but they cannot determine or point out misadjustments in machineries, its working, handling etc which duties are for the technical experts.

The attempt is made herein to explain the principles of efficient management and control of cotton mills and principles that go to determine efficiency, measure it and increase it. These principles may be adopted and the results watched. It is expected that this will be a very useful book and a right grasp and understanding of principles will enable the reader to apply his knowledge with success to particular problems which he could not possibly have time to study in detail.

Bhukhanvala House,
SURAT.

R. M. A. BHUKHANVALA

THE SCIENTIFIC MANAGEMENT IN TEXTILE MILLS

I

THE SUBJECT MATTER & METHOD OF TEXTILE PROCESSES.

THE study of processes in those relationships where motives have different variations in physical changes of cotton and to ultimate results of finished productions. The science of Textile management emphasises the fact that it is concerned with processes and inter processes i. e. with physical transformation of cotton. The old days have gone. As years roll on improvements come in. Spinning done by hands has gone over the hills for the last time. Manufacturing is now understood to refer to the whole range of processes which convert a raw material into the finished article. It is sum of departments and processes which com-

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prises the conversion of cotton to yarn and from yarn to woven fabric. The movement of the industry like that of civilization has ever been west ward. Our land is recognised as having from time immemorial its home and although here cotton has probably been in use for ages as clothing, there is no evidence to show that this substance was ever known in Europe till the tenth or that the manufacture was commenced in England till the end of the sixteenth century. As days roll on new improvements set in. These inventions, the importance of which it is not so necessary to refer to—their details and the story of their invention having been so frequently dilated upon—these created the cotton manufacture. Then came the factory system which rapidly increased and steadily prospered and extended.

Similarly the extensive and well organized association of the operatives for the protection of their position in relations to the masters, have become a power which now resist the masters whenever difference of opinion is arrived at and by the increasing

influence of the employees in all trade questions.

The coming of the factory act regulating the working hours of men, women and children and various restrictions as to holidays, painting, cleaning, reports of accidents etc has also effected the textile industry but the limited liability Act greatly facilitated the working of industries like cotton mills etc. wherein a very big capital is essential.

This also gives facilities for recompense to the workmen for accident or injury inflicted by the negligence of the employer or his representatives. The Factory Act gives advantages to the labour class while the Joint Stock Companies Act to the capitalists. In the same way the variation of tariff changes and amendments, the trade mark act etc. have influence on the cotton mill trade.

Such improvements in these matters have directed the attention of experts in making improvements in working so that better production can be had by upto date mechanism.

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Every attempt is made to improve the machineries and the method of working it so that better results can be obtained with less loss of labour energy.

There are various processes in a cotton mill and each process requires careful study. The spinning department consists of the following processes :—

1. *Mixing.* The process of thorough blending of various qualities with a view of eliminating of the unevenness present in different classes of cotton bales before cleansing.
2. *Opening.* For passing the matted pieces of the bales through the beaters for separating the material into small flakes and also for removal of the heavier impurities.
3. *Scutching.* Removal of the remainder of the heavy dirt, delivering the material in the form of a lap. There is a repetition of this process.

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4. *Carding.* Extraction of light impurities—leaf, dust, short and weak fibres—the process is meant for attenuation of the above results into a thin sliver, in which the fibres are laid in such a position as to be easily drawn parallel at the next process.
5. *Combing.* For the separation of fibres. For fine counts the former process output has to undergo this training. For coarse the custom is to go direct from carding to drawing.
6. *Drawing.* For the levelling of the sliver.
7. *Slubbing.* Inter-Rovings—These are for the gradual elimination of waste and diminution of the thickness of the sliver.
8. *Spinning.* Final process for producing a level clean thread, free

from unevenness in every respect.

9. *Reeling.* For reeling the yarn for hanks reeled. These are then sent for bundling and then baling or the market.

There are nine processes altogether but where the yarn is meant for being sent to the weaving then cotton has to undergo 8 processes. Each process has for it a separate result and has a separate object. Sum total of these objects is the final result.

In weaving the processes are as follows :—

1. *Winding.* For taking the yarn on warper bobbins.
2. *Warping.* Winding of threads on a beam.
3. *Sizing.* This is a process requiring a very greatest care and attention. Special charts are required showing percentage of sizing sortwise. Carelessness in this process will result in great loss.

4. *Drawing-in* The process for drawing-in weavers beams or through the healds and reeds.
5. *Twisting* this is not a process, as a rule this is performed when new healds are not required and when working the same class of goods, or rather weaving the same cloth beam after beam, it is not necessary to re-draw-in the warp but it is twisted-in.
6. *Weaving.* Final process. Combination of the warp and weft yarns, interlacing one with the other in such a manner as to produce a firm texture, fitted for the varying uses to which cloth is adopted.

These are the main seven processes. Folding is the final process for folding cloth pieces according to the fold required and then bundled up and baled. All these pro-

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cesses require careful supervision and control without which, even work cannot be expected. We are concerned with scientific management and as we are concerned with each process we give an idea to our readers about this. At every stage of the process we are to discover the following :—

- (1) The underlying causes of improper output.
- (2) Economy of specialisation and results of economic working.
- (3) The effects which may be expected to follow the actions of adjustments.
- (4) The conditions which make for the greatest efficiency in production and cutting down of costs.

Scientific management, is, therefore, not a simple description of separated unrelated facts. It is a systematised body of abstract knowledge—a general science, it aims at formulating the great scientific laws.

This deals with each individual process which when totalled up gives the final result. The student must infer that process and the inter process is the basis fact to be

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dealt with. This is a fundamental fact and a point which must be mastered at the outset. Without proper and careful study success cannot be assured.

In ordinary course, the sum of one single process is not considered but groups are taken. The aim of scientific principle is not collective, but individual hence each and every process is considered on that view point. The scientific law of uniformity of process is always observed. In all sciences, the method of procedure is to observe and classify and then put forward a hypothesis as regards the causes of variations in production, wastes, efficiency, wages, labour energy and waste in energy and on the whole gain or loss. It's the steady, vigilant and careful eye that wins the game of business. Keep your eye on the ball rolling ...your hope and determination of efficiency and cutting down of costs—plan every move—analyse every fact as though it meant the winning play. It is this steady pushing, pounding, hammering of ceaseless play that lands the ball on the right side of the goal

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line and the profits on the right side of the ledger. The moment you enter in one process you find that you are challenged by a host of competitors. Work therefore, without plans is a vision. Structures without plans are shapeless. As such is the case, always care and attention is necessary so that steadily and securely progress is assured.

We call facts as mere results of each working or stage. These facts are analysed for gradual and regular comparison. Every process is governed by a code of rules as strict, as the laws of mathematics. Consequently when it has become almost certain that a given thing has a specific result or the causes of a specific result is known by analysis, it is still necessary when making a statement to that effect, to qualify it to this effect. Even when causes are in operation sometimes the effect intensifies, diminishes or positively reverses the results. Science has a very peculiar effect. In the Textile mills the most modern system is the application of scientific laws.

Cotton changes at every process, it

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variates, it diminishes in inter-distribution by variations in wastes, improper weights, atmospheric influences etc. and there are certain other invisible forces at work which effect the parity between one result and the other. Every operation is standard but forces have greater influence over production. After a certain process production decrease in proportion to the increase of waste but where production increase there loss abound. The operation of this law is applicable to every class of industry. We are therefore obliged to study facts and figures relating to each process and seek for ourselves the operation of this law. We require surplus of benefits. We conclude from our principles that $\text{process} \times \text{process} + \text{individual labour efficiency}$ increases efficiency and production, decreases costs, increases competitive abilities, decreases chances of loss and finally increases capital or say wealth. Not only this, the bad operatives are thrown out of employment.

There are certain other laws that operate and it may be stated :—

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1. An increase in production with an increase in waste tends to lower efficiency.
2. An increase in production with a decrease in waste but increase in wages and stores tends to lower the efficiency.

The theories just formulated are the basis of scientific principles of efficiency.

A caution is necessary in applying this theory, which like other economic laws, expresses a tendency. Various methods are adopted to control these factors and bring the production to a standard level equivalent to the effectiveness of materials.

Practically all principles are simply instances of causes that leads to greater efficiency. Where single unit of production expands, costs go down, sales increase, return is great. The science tries to show the causes that effect changes in production, in quality and in quantity, points out variations in wastes, inter distribution in spinning counts and weight of each count, count being the basis of calculation in spinning. These changes are measured and set out.

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In the development of these facts the pendulum has swung with a fair regularity between the shares of attention given respectively to unit of production and distribution. There is always a certain reaction against the importance attributed to processes and industrial economists largely concentrate on the question of processes and inter processes. It can be emphasized that problems such as that of efficiency, wages, wastes and inter-allocations cannot be disassociated from the scientific organization. Similarly with regard to variations and vibrations, it is not merely a matter of noting the effects but also of examining the influences at work.

Certain laws and principles become evident. Unit of production is the result. But it is also a most potent factor since it is the fact on which the scientific principles are applied. We have to measure efficiency by the ratios of the output to the human efforts and working capacity of our machines. It is often necessary when examining and trying to understand the measurement, the factors that effect the working. Individual

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economy eventually develops into room economy, shed economy and makes finally economy all round as a whole.

It is interesting to observe that such group development always appears to go ahead of and pave the way for industrial development.

Changes in our methods to suit the external influence have made our organism very complex. Specialization of functions has grown intense while the internal mechanism has been considerably developed by regular improvements in machinery, by the introduction of automatic devices to save labour expences.

We have therefore to organise skilful handling of all processes by adaptability of methods to our needs. We have to accurately forecast market conditions for increasing our sales efficiency. We have to judge our working factors, train our men and develop them and handle all in that subtle meaning that implies sincerity and tact and force and that gains confidence and co-operation.

The likelihood of securing increase in

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productivity, sales, internal management, depends mainly upon applications of science and in the development of costing and efficiency systems. It is no use to cram the memory with details. The acme of the system is to automatically care for matters that arise of the statistical working datas and use the brain to conceive new ideas of developing new plans.

Our system should be all constant so that we may be in a position to detect the marginal unit and variations between one unit and the other and ascertain from within the position that is created for us and the position where we stand. It is not a friendly wind that will pilot our business into the port of profits. We are bound to statistically devise and then chalk out our voyage before the list of the anchor or setting the sail of action.

In the creation of one final unit, there are various so called process factors at work. The complexity of mixings, variations of waste percentages in it, inter connection of one quality of cotton with the other and

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its gradual treatment for physical change. These factors variably change according to the internal working and allocations that have been fixed and change the results at every stage, although the first process of mixing is constantly related to the last and final process because the pound of cotton has a regular connection with the ounces in the spinning plus the variation and waste.

Every item betwixt the first process and the second, call for analysis not only of units of production, waste allocation over particular mixings but of labour employed, individual efficiency and stores consumed, power spent and tabulation of inter distribution, loss of efficiency, misadjustments etc. all of which take part in giving the final result.

We have to treat our subject on scientific basis therefore. In a scientific treatment, facts are observed, collected and classified hypothesis and inferences are provisionally formulated. Owing to keen competition improvement in internal management has become absolutely essential and Japan is an example before us. We have to build up

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our structure on principles that lead us to withstand competition. We have therefore to deal with processes, cause of variations in results, effects due to labour activity and adjustments to suit our requirements of better gain and to enable covering our selves with ample return.

From the above it may be understood that process is an important factor. One may therefore begin with an enquiry into the nature of processes and into factors that go to produce better efficiency, production, less wastage, leaks and stop wastage of human energy.

It is truism that every industrialist desire production that would lower his costs. Modern conditions and keen competition make it practically impossible for any industry to be economically self dependent without specialisation. This requires applications of scientific laws to each individual industry. Strict adherence to a few cardinal principles of management makes the internal control efficient. I may state here that the present methods of training our operatives

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have innumerable defects and a better suggestion would be to keep the internal working by a frequent interchange of duties. Emphasis may be laid therefore on the obvious importance of the human element, of the principle of promotion on merit and of a systematic interchange of duties and can state that such adoption is sure to contribute to the moulding of the Mills of the future.

Experience shows that many of our men in the line have a practice to nail to a solitary tree but such a practice is detrimental to our industrial interest. They are a warning to the owners to shun a path that is wrongly made out for them that lead to loss and ruin. We must have a body who are possessed of intelligence and knowledge and who can display their knowledge for the interest of the industry. Work done without organised effort meets every eye with suspicion. Such an instance of careless work is an unfair game. Everything rests upon an efficient system.

Changes in our industrial methods and

structure call for regulation internally and externally. The unfettered extension of the system of production is responsible for many evils and abuses, which goes unchecked, gradually increasing costs with ultimate result of loss and lock out of an industry.

To obviate troubles arising out of this and to stop abuses immediate attention is necessary to the inter influences at work which require careful analysis of working by process to process including the power process that is the main power factor and that drives the preparatory and other machineries.

Specialization of technical thought and enquiry is necessary as there are principles that govern the technical working. Again the present conditions are reflected in the current procedures and processes. Necessity of an efficient check is fully realized and economic analysis is essential to govern the operations. The manager who determines with absolute accuracy what a process means to him, whether it means a fair working or not, see in his mind's eye the chain of

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evidence that he is fashioning and he only can make the chain exact, logical and convincing.

Reaserches and growing use of statistical records have served to check imaginative figures and keep the industry within the bounds of reality. Experience has shown that the subject matter is not merely a matter of academic interest but has important bearings upon such questions as efficiency, individual costs, waste variations, complexity of combination of two and three varieties of cotton, different counts of yarn combination in cloth, individual loom efficiency, pick etc. Even labour efficiency, individual fatigue questions can also be studied from such statistical datas. The only thing required is its proper arrangement and set up.

The increase of knowledge leads to increase in production. Every one can see how enormously the productiveness of industry, in spite of possible temporary or local diminutions pretty steadily increased.

The ultimate causes of this increase are, we may reasonably suppose, the same as the

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ultimate causes of internal improvements and progress.

Small improvements are constantly being suggested by the teaching of experience so that productiveness of industry increases as knowledge increases even when there is absence of the more brilliant inventions and discoveries in the line.

The enormous progress made in textile science, whilst commanding the admiration and thanks of humanity must bring in its train an element of grave danger and an expert mind is needed to control the stupendous forces.

Higher organization of textile industry makes working more sensitive but also more powerful both to resist and to recover from various external disturbances. A simple weaving shed or a small experimental spinning shed may live for generations but may be destroyed by a succession of bad periods or cycles of adversity. An operative may lose his occupation in consequence of a new automatic device or labour saving device. But where there is an efficient internal

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control, the industry cannot disappear but it will gradually thrive and employ more labour than were employed before.

As such is the theory every conceivable precaution is being taken to reach and realize the truism of the theory, even then there are instances of severe losses. The incalculable margin of human error must always enter into the order of thing resulting in the finest production proving a menace to safety. It is an accepted fact that greater responsibility lies on an employer who is bound to use his head rather than his hands.

During the past few years production methods and administration have changed rapidly. Mills can no longer be operated haphazardly with a percentage of faulty output and greater wastage. The cost of labour has risen and it is no longer economic to have a skilled labour on any task capable of being mechanically performed. Mass production has come, and there are strong economic reasons for its continuance. The knowledge of stimulating effort without

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leading to waste has now stepped in. Study of the operations as a whole has become necessary. The system employed must be flexible to permit of development and yet insufficiently rigid to prevent waste, inter departmental friction and inefficiency.

The sequence of operations must be planned. The working should be laid out in such a way so to secure smooth transit of the product from process to process. The standards of time and rest and of rate must be compiled and computed accurately. In order to compete successfully with growing competition scientific methods are applied which justify the position of the industry by sound financial returns.

These sound financial returns only lead us to build up our industrial structure.

II

THE THEORY OF SCIENTIFIC CONTROL.

AS years roll on improvements come in. The hands no longer stick to the last. Work is done by machines. Specialisation and mass production has come into existence. Competition has raised its head, tastes have also varied and with this gradual change in trade, has come as gradually but as surely a change in methods of control.

One man work has disappeared. Instead the authority of one man has been given in charge of an individual who is responsible for carrying it out. The division of labour is fundamental to modern industrial organization. It means specialization of labour power, both among groups and in-

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dividuals in such a way that the output is greater than would otherwise be possible. In primitive times there was no specialization, beyond the apportioning of heavy and light duties among men and women respectively.

As industries developed the divisions of functions evolved more or less spontaneously. Faulty co-ordinations of specialists is an important cause of depression and unemployment. The advantages of this division increase production, lower cost of production but with this is combined organization. It is a fact that a skilful allocation and co-ordination of jobs increases the output but it should be controlled by ideal entrepreneur who must possess foresight, the power of judgement, the knowledge when to take risks and the ability to lead men and inspire confidence. We have science, the theories of which should be constantly tested in the light of practice.

The division of labour have increased the opportunities of leaks and wastes in management. All these require very careful study

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and control. Machinery and men, materials and methods, market and financial problems are all considered from a new view point the scientific.

The scientist analyses the complexity of a substance to separately find out the substances and its percentages, similarly industrialist studies the whole situation now on the laboratory method instead of rule of thumb procedure.

It is necessary for every one interested in the industry to study and analyse with great accuracy the details of working and control. Unless this is done formidable difficulties may be experienced. The efficiency of production depends upon conditions which may vary greatly at different times. Every extension, no doubt tends to give an advantage. If an industry is properly managed and on most systematic lines, there can be no doubt of best returns. During these years when keen competition is felt, business cannot be successful unless all its operations are conducted with energy and unless economy is secured by constant vigilance.

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There are certain fundamental principles concerning scientific management which should be kept constantly and steadily in view. Materials can be had, nature supplies it, but fashioning these materials require some labour and certain process. The cloth cannot be produced in one single process. Cotton has to pass through many complicated processes each of which require labour and supervision. Attempt, such an examination, and we at once become almost over whelmed with the endless series of processes and work of labourers in different processes and in different capacities who have ministered to the production of so simple a commodity as a piece of cloth from the carrying of the cotton bales to the bale breaker to finished production of yarn in spinning, again from winding to weaving and finally to warehouse. Material passes through the hands of a succession of workmen and through variable processes wherein both human skill and technical knowledge is essential. Every human factor is considered every process is analysed before reach-

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ing the point. It is not worth while to be carried into endless ramifications while ascertaining the variations that either directly or indirectly effect the various productions.

Before the characteristics which differentiate the productive and variations internal, are explained, it will be necessary to revert to our primary conception of analysis. Without analysis of figures and facts the material combinations, its various complexities and inferences cannot be drawn. When groups or classes are recorded over a period of working hours a continuous series of operations can be obtained. This continuous series go to check the internal working. These series can be termed as scientific series of productive continuity. Then follows tabulations of numerical facts for obtaining requisite information of a particular group of mixing from which number of counts are produced. Complex tabulation is for compound yarn numbers of warp and weft in cloth. This is a scientific system of a special character designed to analyse and distribute process units over other processes and to

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indicate variations between one result and the other, the sum total of the results is the final result. This is not cost accounting. Cost accounting aim at so identifying and localising expenditure as to bring out the profits earned or loss sustained in connection with individual units. Here we are concerned with processes and scientific principles controlling it with a view to gain more and more efficiency. We are also concerned with labour and human energy ratio consumed in and on a process. This ratio is also extended to fatigue and our analysis result in individual complex result of the three main factors controlling production. Science plays a greater part than a system in a cotton mill. To realise a greater efficiency, to reduce cost of labour and production, to control the variations, wastes and leakages various methods are adopted but methods based on certain laws are preferable as these arrive at certain fixed results. Tentative standards are set in to obviate internal troubles and for obtaining standard work.

We have come across certain mills who

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have launched a system of giving their employee training for doing clean, clear and quick work. they should be made to understand that maintenance of high speed of production is to receive higher wages. The employers should do everything in their power to train their men to attain efficiency.

The human factor must be extensively exploited.

An average labourer in an Indian cotton mill receives wages per day much lower than an average in an English mill but the low efficiency of our labour makes the cost of labour higher. To reduce this a system has been introduced for the measurement of human energy in relation to the work, so that actual honest work done can be ascertained and where there is waste, there it could be controlled and adjusted towards giving more work.

In fact it must be understood that the management does not consist of sets of rules and regulations, forms or charts, instructions and orders which is found in many of the mills. It is a policy of establishing a standard

way of performing each operation with economy in material, energy and capital. It is enhanced by every cause, whatever that may be and which increases the production of an industry without giving to any one a claim to an increased remuneration.

Some of us do confuse overwork with what is really underwork and it is only under a compelling incentive that we finally discover that we are in the second wind. It is not a good policy of finding out errors but it is the best policy to point out and then rectify it showing to the operative how errors are rectified. If the man on whom responsibility lies is of sound judgement he will be able easily to adjust errors in the right way and also train his men not to commit again. The organization should find out best means for such adjustment and easy performance of each work. If efficiency is low it is the duty of the upper group to discover where the error lies and not to adopt the old methods of attacking the problem by lowering the wages of his men. Lowering wages means lowering efficiency.

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It is a very bad practice and a misleading theory which leads the concern to grave dangers.

Again where costs have been found higher it is not a wise policy to increase selling prices. Selling prices and selling commissions may be fixed on the basis of actual process and individual process cost experience. Inefficiency, whether existing in the form of waste of material, time or other services, may be brought to light by analysis of production and then eliminated. It is not proper always to be guided by accounting. Standard should be based on past processes by carefully getting each process from mixing, down to spinning analysed.

A system of process accounting and monthly balances should be introduced for the purpose, which will itself point out the erroneous position wherever there may occur. This will also help to check the result of the processes and will lead to detection of even seasonal variations in processes. This will also show the actual working position, detect irregularities and finally help in fixing

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the variations of waste etc and fixing the standard of each individual performance.

The problems of wages also should be controlled likewise. Every payment should agree with the total production wherever this is the basis of payment. In matter of monthly wage the sanction scale should be made and the payment to agree with the nett sanction scale. Any variation in the net total means failure of sanction scale policy.

Labour is productive when it either directly or indirectly embodies utilities in material objects and as such it effects labour costs.

Any advance in wages which reduces the profits below the current rate cannot be permanent. No remedy for low wages can exert any decided permanent influence unless it increases the efficiency of labour. We have to study our men first, to understand their ideas, their system of handling materials and their method of doing things. If there is any error we have to get these rectified.

There is scarcely a process which does not require a mental as well as a physical effort. Our industries require, skill and in-

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telligence. In order to realize satisfactory profits, costly and complicated implements must be used and that these cannot with safety or advantage be entrusted to rude and ignorant workmen.

Our mill owners complain about depression, they complain of competition, they complain of the rise in wages. To them we may state that increased dexterity, greater power of concentration, superior trustworthiness, quickness in discovering errors are some of the faculties that are required in building up sound industrial structures.

A not less important influence is however indirectly exerted by education upon the efficiency of labour and upon the prosperity of our industry. Our labourers are unable to read and write. Frequent allusion has been made to the deplorable ignorance of our labourers. It is a fact that we suffer a severe pecuniary loss if the industrial efficiency of those by whom actual prosperity is produced, is impaired.

Each year facts are coming to light which show that the competition that we have

to carry on with foreign countries is more keen and more closely connected and the balance of advantage may not improbably ultimately turn in favour of the country which have the most intelligent men. Statistics indisputably prove that our productive efficiency due to ignorance of our workmen who are never guided in a proper way fail.

It is almost truism to assert that an intelligent labourer is, as a general rule, a more productive workman than one who is unintelligent for instance a man of active intelligence can adapt himself much more readily to changes in our various processes which may be rendered necessary by improvements in machineries, than one who is sunk in stolid ignorance. It is also important to bear in mind the effect that may be exerted upon working efficiency by any improvement in the moral condition of the labourers. As an example, reference can be made to the fact that with each advance in the trustworthiness of workmen a smaller amount has to be expended in the mere supervision of our men.

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The supervisor must cultivate men, call in meetings and discuss with them every problem, show them short cuts, attend to their grievances. The result of this would be an improvement in quality and quantity.

When this is the case a greater return is sure. When the quality improve and the quantity increases, efficiency will increase and higher wages result from it. The advance so made will be generally accompanied by a corresponding increase in profits.

There are other methods too. A cotton mill can be converted into purely co-operative basis, if the operatives employed in it were able to subscribe amongst them to purchase the mills and to carry on the business on their own account. Co-operation has been rarely applied. In India the experiment of applying co-operation to productive industry has so far not commenced.

The main purposes of scientific applications are for the discovery and measurement of changes in the energy of human labour. By these means, a comparison is obtained of energy actually consumed in a process

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and that wasted owing to the inefficiency of labour.

The energy analysis afford most valuable data for comparison. Reference to them is frequently made in the settlement of wages dispute and also in questions of more technical interest such as efficiency and individual production.

A department should be opened or a person appointed to collect every month figures of time and machine working including machine working, stoppages for stores etc. We must have forms so that regularity could be maintained. We have also to work out the number of units the average worker should be able to turn out in say nine hours. A minimum earning wage then should be fixed and any man below the average minimum should be warned.

It is impossible to study our industry without scientific methods and cotton mill management is an exact science and a definite profession.

The man who has put in his money is not required to study but a man on whom

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responsibility of management lies should understand that it is his duty to study the industry in which he is interested.

The system in India is to hold the manager responsible for management. If the results are not good the Mill Agent will at once dispense with the services of the manager and appoint another man. Well, here the owner will never go to investigate the causes of improper working. This shows the inefficiency of the present management. Belief that new ideas and inventions should be shared by every body has not yet developed. Efficiency is perhaps the most valuable factor of nation's industry.

Cheaper are the materials but wasting of human energy and efforts in doing things are dearer must be known by every industrialist and those who do not know this cannot maintain supremacy.

Labour is always separated in two groups viz productive and unproductive. Productive labour means that labour applied directly to the productive processes of the plant while the unproductive labour is not

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expended directly in the manufacture although necessary to every operation.

The labour psychology therefore must be studied. With study, labour control is not possible. The employer should co-operate in all directions towards making the operative a higher producing unit. This benefits the mill as well as the individual labour. Systematic work reduces cost of production.

As with labour an effort should be made to get the store cost systematized. The best means of doing this is the establishment of a central stores room. This store room should be arranged either according to process or departments but the former is preferable. The officer controlling the operations of the store department must be honest. Exact quantity requisitioned should be issued and a monthly analysis of departmental issue should be prepared every month and every quarterly comparative statements should be drawn up to enable variations in consumption marked out. In matter of materials used in sizing an analysis should be maintained in the sizing department showing the size

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used on a particular count.

The store stock must tally every month with the ledger and differences in weight should at once be reported. By correct arrangement it is possible to get all the information including the finer separations. A properly balanced books proves a big time saver.

Proper supply reports are guides for the location of high costs. If an efficient supply force is maintained, it is possible to find the exact items consumed, the specific places used and the reason.

In addition to a check made on stokes, a check must also be made on coal. Proper weighment should be recorded for receipts and issues. The issue must correspond with the energy produced plus the ash. Every pound of coal must produce a specific content of energy which then, is distributed over the manufacturing departments.

This energy is measured and this measurement ensures a greater efficiency and less consumption. The engineering department must have an adequate data of energy

produced or power produced and distributed plus waste in power. Power plus waste must equal the production. The difference can be fixed from such a data. In every factor scientific law works more or less. The qualifications introduced must be very carefully noted; It is easy to draw false conclusions as to the extent of loss and variation unless conditions are carefully specified.

The same is the rule applied for electric departmants. Here the unit is measured. The distribution of the power plus the loss in transformer is the total unit produced. It should be noticed that gross unit produced or receipts is the total of all meter reading and if the meters are not in perfect working order there would be a wrongshow. Under the circumstances every meter should be tested quarterly of both the high and the low tension. Analysis of distribution of unit energy should be kept so that it is possible to know where the energy has been used. Where there are individual motor drives there a proper individual check is required

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so that proper adjustments and distribution over the departments could be made.

In the case of lighting too, a separate analysis should be kept showing the number of bulbs in the department, the average life of each individual make of bulb. Such invisible loss as waste in lighting, waste in power can be detected if proper statistics are kept.

It has long been observed by practical industrial economists that apart from loss, there are marked negligence which alter the position in a rhythmic manner. The causes of loss is not only due to negligence but it is also due to errors, misadjustments, waste in efforts, waste in energy, waste in process etc. There are other stages also which may be stated as follows:—

1. Appreciation of production by constructional entries and approximate arrivals.
2. Speculative effects.
3. Waste of energy by misdirection.
4. Erroneous mixing experiments.
5. Undue pressure on labour.

All the above factors require careful study.

In cases where balances do not agree it is a practice of the clerks to adjust the balance any how either by increasing receipts or issues which for a long time remains undetected, this practice can be stopped by abstract analysis of productions and distribution.

The total of all the columns automatically agree with the succeeding departmental abstract.

Sometimes it happens that the departmental officer to show the results that would make his position strong in the company increases production by change in speed or pinions which cannot be detected and thus give speculative effects. This is a very bad practice and the mill owners should understand that such men are detrimental to the interest of the Company. To have a proper check working statistics is suggested. This will show the changes whenever it is made. This is further confirmed by weekly checking of the machineries.

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In matter of waste in energy it has been found that the work that has no importance attached is given to an operative. If there is any rectification or adjustment to be made the jobber never care to show the right path. The operative therefore has to adopt a wrong method and when he is not able to adjust he finally refers the matter to the jobber. This is wastage of human effort. Bare, badly covered cloth, cracks in cloth reedy etc are causes of faulty direction of working. There are also floats in cloth, short picks, etc which are all due to improper direction. The weavers must be made to understand their duties, the method of piecing up the broken ends of warp and drawing them through the healds and reeds, filling the shuttles with weft and placing them in the loom, oiling and performing simple repairs and adjustments. Unless this is done work cannot be properly done.

There are principles which are axiomatic and mathematically inevitable in character and its application just give the result reverse. The student should carefully compare

these tendencies with one another and endeavour to focus and picture in his mind their general nett results and then apply any principle that seem to them suitable and giving better results than those they have previously tried and experimented.

Every industrialist with a whirligig in his train must broach new opinions and those made canons, sometimes as sure as if science had confirmed them. This freedom left to the industrialist has build up splendid structure of the industry. This must continue. This is a period of reconstruction and therefore always a protective system is desirable and we humbly believe that whatever may be best suited to the times, freedom to pursue the individual course, at any rate in the matter of advancement and prosperity is essential to our industrial growth.

If the reader will study the facts he will be able to convince himself of the tendencies at work always. What we desire is to remove the tares from the good brain and what we see as we look back that it has been impossible to decide the course

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but the application of science removes the tare.

Just as hand spinning and weaving has been transformed into highly and upto date mass productive by modern machineries and the musical movements of finer part as dobbies and jacquards has been adopted for very fine productions so those systems that offended have been transformed to most scientific problem to-day. The science now plays a very important part and the day will come when scientific motions will be controlled automatically.

We have come in the age of statistics. This type of information so valuable to the industrialist, has become remarkably popular now and the statistical experts select the best methods of compiling all informations, whether it be good or bad, whether they commend themselves to his judgement or otherwise—he is just an historian who records the past, the present and the future based on past and the present experiences.

He is not a critic but he opens the way to criticism.

Of, course, in that somewhat extraordinary

conclusion we see the very tendency that is in work, altering, modifying and transforming. It is not the process of bobbing and shingling the facts or the figures.

What a stroke is when we say "process" a word carrying complicated thought into formation. It is the outcome of the final result. It is an expression of an economic thought. Every process is the formation upon which the power of evolution in generation after generation has worked, until from its central notion has grown a variety of connected and radiatory principles.

Arising out of the study of processes comes the study of human factors, mixing manipulations, waste variations, vibratory influences in machineries creating loss in life etc.

To our minds each process is build up of infinite diversity of things and therefore of results, but to us, the whole is the sum total of such things, the result of which we can obtain by variety of ways through the help of science. All differences have a similarity; the stuff of all processes is the same

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and therefore any result be likened to any else. This is ground on which we have to build up.

III

THE ONLY WAY.

IT is possible to classify the methods of working it and reduce to written rules the best methods and then forced upon to be put in practice. It is necessary therefore to analyse the departmental working from Blow Room. The wastes and the percentages of each waste per separate mixings individual analysis is necessary to enable the same to be minimised.

The costings and the Accounts department also should devote themselves in determining in detail energy factors and fatigue by wages account and labour details with each process together with relative output.

This will effect gradual increase of efficiency and economising labour. It will render labour more efficient. Innumerable ins-

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tances might be given in which labour has been thus economized to a most remarkable extent. Numerous instances may also be given of the extent to which employers are induced to economize labour by the introduction of improved industrial processes.

When trade is unfavourably effected by any such circumstances as a deficiency of cotton in equal staples, stores of standard quality etc these introductions splendidly work.

In their gallant struggles, in the difficult times, our mills have greatly reduced labour by continuous improvements internally. Here also I may state that our mill owners will be greatly recompensed if they adopt a practice of giving higher wages to their men who demonstrate such qualities as will tend to betterment of quality and production.

Following this, there will also be improvement in the work and will encourage the worker to attain a higher standard. If any department is found out of the line, immediate steps can be taken. It is also necessary to maintain a good hand who

can interpret the instructions and when any difficulty arises, there to show the methods of solving it. Educating labour is of the greatest advantage. In addition to this the system should be introduced whereby accurate returns can be had.

Efficient systems are linked with scientific management which involves a detailed study of the processes, involving both time study.

We are concerned at regulating the motions and minute operations in such a way that the work is done in the minimum time and with the minimum number of motions.

There have been instances of oppositions by labourers. They object to the time study methods on the ground that the good average man, may be well above the average and that unscrupulous employer or jobber may thereby speed up the production beyond a reasonable degree. They also object to the motion study and they understand that such a course may reduce them to mere automatan. These understandings are merely misleading and it requires careful explanation.

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This sort of misleading ideas in them lead them to many a weary mile away from the regular road and their wrong believes force them to leap hedge and ditch to get back into the route again. Their resistance make them flat and dull and lead them round and round, merrily chasing their own tails and gambolling in all the frolic of unrestrained freedom.

Time is money. To industrialists there is a greater value in time. Analysis of time therefore is essential. There can be little doubt that such a policy, if pursued, would within a short time produce remarkable results.

By improvements in labour, by concentrating methods of internal working, by the development of time and motion study and by greater attention to minor matters, the textile industry in India might be made amongst the most important sources of national income. It is for the capitalists to take upon themselves to improve the internal working, that is, to make analytical survey of all the facts, whether, it be process,

material or labour.

The administration of an industry means the arrangements that exist in the industry for maintainig higher efficiency, lower cost, standard output, lower waste, for securing progress and development.

No industry can prosper which is governed by unsound internal administration. It may make its arrangements through subordinate authorities to whice it may delegate some of its supervising functions.

The internal system of control does not grow up in a single day and can hardly ever be said to attain absolute fixity.

It has to be adapted to the changing material and the needs of the finished material. It grows in complexity as the process to process expand and each multiply.

It is therefore best studied in its technical aspect. It has also to be seen how far the administrative machinery is fitted, how far the accounting machinery is workig to meet the regular say.

Experts have always struggled to produce systems for controlling those factors that

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operate internally. The systems which makes figures read the past, present and future of every process, human energy, waste, variations and working units have been finally laid out as a centre pivot, of all operation.

We refrain from giving rulings as this would make a very big volume if we do so and therefore leave the framings in the hands of our reader to strike the line to suit the respective requirements.

It is not possible for us to know the percentage of time wasted by our men in wandering, in going out several times for smoke or for any other purpose, in stoppage due to badly lay out of internal transport. All these and improper management go to the debit of our profit and loss account and increase of the home cost of goods.

It is not the working of the machineries alone, nor the special processes, nor the exclusive management nor any of the other tricks in the capitalist's pack finally gives profit or cut down costs; it is the manner in which every day problems are handled. The average capitalist always seeks profits.

His most disastrous mistake in his management is to loose sight of the great fundamental principle on which his profits hinge.

As long as the manufacturer fails to adjust his view point, as long as he is not in a position to understand the internal distribution and variation, he fails to realize the actual gain or a gain that he is rightly entitled to receive. Too much latitude in the management and too much laxity in internal control results in failure.

The strenuous competition in textiles and the narrowing margin in profits on all sorts, make it necessary for careful scrutiny. It is therefore necessary to give every figure a life making it breathe a spirit of human interest. Every one concerned must be inspired to raise efficiency and confidence in one's ability which is the key note of success.

It is difficult to get most out of the field. By intensive cultivation and accurate analysis results can be multiplied manifold. Co-operation no doubt with labour is necessary. Some method of encouraging co-operation which keeps the working force

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interested should be adopted so that errors due to carelessness and ignorance can be lessened.

It is necessary to establish a department, the sole purpose of which is to trace back complaints, errors, misadjustments etc in order to devise a remedy it. The departments must have comparative records showing the process results and energy, consumed and wasted to guard against loss.

Many mills have found it a good business to go direct to the working force and engender the proper feeling of co-operation among their men, to secure greater efficiency in work and in production thus to ward off many errors.

The departmental officer or the officer in charge of the mills hold frequent meetings, either, including all the departmental officers or taking in, the entire working staff of a specific department, to discuss on various problems effecting work. Employers are encouraged to tell of any difficulties which they believe should be remedied. These meetings also consider the complaints

received and ways of eliminating them.

The mill owners who are successful in eliminating the complaints, make an immediate adjustment.

There can be no doubt, that the plans are costly, checking, inspection and control systems are a big expense, but the outlay is of small consideration in comparison to goodwill and future prosperity.

It must also be understood that the loss of profits hinge on the small and trifling activities too. These are not to be taken as affairs to be neglected to junior members.

In a particular investigation as a loom where the weaver was a skilled one, it was found that looms under his charge where stopping at intervals for refilling and the stoppage was more than usual and although, he being a skilled one could not reach a standard which was fixed by 85%. The cause of such a length of stoppage was investigated and the error rectified. Every motion of the weaver was recorded. How he stopped his loom, how he restarted it, how the empty pirn was removed from the

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shuttle, the method of his tying knots as well as every condition surrounding his loom with equal minuteness. Records of timing and stoppage were recorded. The result of this investigation was intimated to the mill owner and also suggestions given which were followed up and the same weaver now gives 90% efficiency, much more higher than his former average.

There probably never was a time when so much attention was given to these matters. Even in case of spinning we have tested by giving higher speeds and keeping the men in perfect confirmation with the changes and we have marked higher productive efficiency.

In matter of folding also we have tested. Very good results have been marked in warping, sizing, drawing and many other subsidiary processes.

Scientific subjects form a large part of our industrial programme and this when operated makes the fashionable and amature systems to disappear.

Experts have investigated, they have

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devised systems but no consideration was paid to the permanent conditions and we are concerned here to give a proper bend by taking far more account than who did of the individual processes which compose in the whole.

We have to study the conditions of steady internal progress by maintaining exact and accurate results by proper records of departmental working, each separate and distinct, labour analysis for ascertaining actual individual efficiency and average efficiency on the whole shed separately, power allocations etc. The average efficiency on the whole can be brought down to individual efficiency by time tabulations also, as without this there are no other methods of distinguishing men except through the judgement or favouritism of the departmental officer or a man in charge of a particular line.

We have to deal partly with process and partly with men, partly with intellectual qualities and partly with the physical work. We cannot leave one or other of these

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sides in the back ground.

The process is fixed but the material is constantly varying each of the elements which enter into it, is also variable; neither for materials, wages nor machineries are the changes definitely fixed; they vary according to different circumstances, according to certain invisible vibrations.

Slow and steady, investigation, analysis and charts are the precursors of decreased costs and multiplied profits.

It must be understood that our internal organization is not a machine; it is living and has to be self-adjusted to fit to the changing circumstances. It is therefore necessary to keep individual working records in each process and therefore individual records are preferred. The arrangement of the work should be so done to make supervision and control possible without wastage in time and human energy.

If organization as such is brought into effect it will surely bring increase in production even when the working hours are less. reduce costs of production not only on the

whole but also on each individual qualities according to the variation in its construction.

Prosperous times often enable even a badly managed concern to get ahead but in period of slack or shaper competition, hopelessly high expenses and costs become visible. It is necessary therefore to enter very conspicuously.

All information, such as of demand, variation in rates, wastes, tastes, new openings etc should be kept to date so that chances may be taken. Specifications may be outlined in short motions and figures, then motion and figures may be specified.

Without regular system no work is possible. The mere word "system" means nothing till it is understood and followed. Unless care be exercised, the technical language of the processes may prove misleading but the points if properly studied may appear of very great interest. It is not easy to convince others, complaining of their own adopted methods without actual evidence of facts that may help representing their faults.

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Among the many forces at present working in the development of industries, perhaps the newest and most striking is the scientific movement so successfully engendered in the case of cotton mills,

The demands that this movement has made upon the organizing ability of those whose concerns are devoted to industrial and technical life have been great and they have been so successfully met testifies to the intelligence and vitality of all concerned.

The controlling department lays down sets of instructions of work, forms of supply and requisitions of stores and limitations based on consumptive charts, qualities of materials labour charts and limitation of employment, rules regarding use of certain stores and penalties for improper use. Not only this but various instruction are laid out which leads the forces to work properly.

The looking out of the follow up, is left in the hands of an expert, upon whom nevertheless there should be an effective check. It is to be understood that bad influences in circulation are thrown off when good

influences are at work,

All these facts help in determination of the best and the shortest cut in reaching the required efficiency. This part of the work is left with the technical department which constitute of first class technical men.

The modern system of controlling the external and internal position is by having a perfect cost and a process accounting department and above all a statistical department. In this part of work generally the facts are collected by the statist and probabilities and averages in connection with production, inter-distribution, waste allocations are worked out. This keeps the mill in perfect balance always. In case where the mills go out of the proper chain, this always holds on.

Many important advantages accrues out of this. The art of computation is undoubtedly of much value in our technical life and the habit of investigating the principles is absolutely essential as without this no problem could be solved. Mastery of figures tends to concentrate attention, induce

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habits of patient abstraction and accurate thought, to familiarise with the laws of reasoning and after all compel us to examine well the grounds of every inference we draw.

Science has become an instrument for disciplining the judgement and improving the mental powers. Every process is justified by reference to some definite rule, and if we are sufficiently advanced we can recognise and interpret it when we meet with them in whatever way it is placed before us.

While proceeding to such developments we sometimes are confronted with the difficult task of finding and training capable workers. It is absolutely essential to make our men feel that they are directing the destiny of the industrial concern. They should be supplied with statistics showing the weekly output line by line.

The best way is to have these matters discussed in a weekly meeting, suggested before, of labourers, jobbers and officers and place before them the position of the individual departments pointing out to them where the position is bad and causes of such

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disturbance. All this, inspires our men with esprit de corps, which is a very valuable asset.

We, in India, refrain from introducing the spirit of co-operation and that is why our progress is retarded.

We must study the psychology of our men. A standard system of instructions and a polite style should be introduced so that our thoughts may be transmitted in their minds with little difficulty and create an impression in our favour.

Every effort of our untiring energy should be directed to the realization of our supremacy in industry by the power of concentration and by removal of false ideas, selfish habits which bar our progress.

Does not, perhaps, in this lie the secret of quiet but continual influence—the persistence of which mere intellectual eminence can hardly suffice to explain ?

It is therefore, essential that the employer should co-operate towards making their operations higher producing units and to employ secret agents to discover the invisible influences at work in degrading

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the efficiency.

If introduction is decided upon, instructions then should be issued to all departmental officers, to hire men to the needs of the system and then a policy should be outlined. When the preliminary steps have been taken, it will be easy to get the abstracts ruled down in way so that all the information essential can be had, who will transform your ideas in written rules and prepare for you a system that will very efficiently work.

Better work means better return to you and to the labour. A right to demand compensation in case of better return then arises and cut system disappears because this is an evil.

The mills whose management are considered to be faulty, never care to see and study the labour factor but strike out rules upon their personal experience which works against them finally. They are under the impression that the same are to their favour. Theoretically these seem to be so but practically not.

Improper maintenance of discipline and

The only way

equanimity has lead to strikes. There are innumerable instances before us. What is the cause. This is due to improper control of human factors. Again inspection and enquiry are never heard of.

System of inspection is equally important. Every unit of production must pass inspection just as cloth pieces are done by the cutlookers. Many of our mill friends do not pay concentrated attention but rely upon jobbers and some of the mills rely upon the clerks. The result of such method is that the fines which are sometimes very heavy, are imposed upon workers who in the long run resent.

Where such are the methods, there improvements can never be expected, productive efficiency cannot be found increasing, on the other side we will find waste percentages increasing. Work done according to varying judgement of individuals have always accomplished opposite results thus drifting the whole industry in a sort of chaos and finally to close up. The cause of unemployment is this too.

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The bonus system in its various adaptation will do much to solve the problem, for wherever it has been used there defects have been eliminated. The object should be the advancement of labour and maintenance of friendly relations with them. This system should be extended to monthly paid workers too.

In management based on systems which scientifically control the external and internal activities, the mills have not to depend on individual judgement and the coming and going of highly paid officers, do not effect the method governing processes. On the contrary it automatically develops its own staff materials. It supplies graduates from bench of jobbers, supervisors, mistries and even from clerks who are able to apply short cuts and economic principles and able to detect any glaring waste or lost motions in each individual operation hitherto unfamiliar, are able to teach the cost reducing way. From the other side comes an expert who balance his rival's productive efficiency by knowledge of methodical means and

The only way

setting plans. This lops out wastage and chalks out a line for the future.

Machineries have been now so improved and to such perfection that by virtue of best management based on scientific principles it is now both profitable and possible to produce almost any kind of yarn and cloth. In the management of a cotton mill the main thing is to keep ahead with production and quality. As a proof of what rapid strides and real progress our foreign competition have made and are making, it only needs to be pointed out that many of their establishments are properly fitted up, well maintained and successfully controlled by themselves without outside aid whatsoever.

It will therefore be seen that our rivals, are fast approaching high standards both as regards the making of the plant and the quality and quantity of work produced.

They have fully equipped internal systems and men to control the external activities, sales, advertising, etc. They have up-to-date charts and diagrams showing the position

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of spindles, looms, sorts and sales every month and efficiency in every particular branch. The labourers have the considerable advantage of high class, well acquired and well disciplined men and they are fully alive to the many and the great advantages with which they are surrounded and that they very wisely enjoy and make the most of them, no one, who knows anything at all about the matter, will attempt to deny, that they are now well able and do successfully compete our products, in our markets and upon our terms.

We should not cultivate our ground carelessly and thus reduce our quality by mere tricks. In so doing we are not only dishonest but we also force our quality to be thrown out from demand and thus reduce the purchasing power.

The application of any principle lies first in investigation. Coupled with this is organization. Every pound requires a test, every step requires investigation, every yard analysis.

Experience has taught us that it is absolutely impossible for us to combat the

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various forces that are at work unless we are fully organised, unless our labour is efficiently organised and our system upto-date and scientifically fortified. We have not to quarrel with each process and find fault with our labour. We have to find out the causes and then proceed further to check it.

Our process results depend upon our special knowledge of primary, detailed processes. One applies short cuts, another devises means and methods of giving better production by change in working. Each has a method to apply.

At first sight our suggestions may not appear quite clear but if these are carried on, the results will give an evidence of these facts. All those who will give thought to the various problems, will know well enough that everything is based on the closely linked development.

If one makes a survey of the different stages of development he will be able to realize that something is not in order, in our affairs.

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We may state that the present condition of depression is due to improper working of the various factors and forces and study of all these are required.

We have seen more than once that our productions vary from one extreme to the other. To obviate this we adjust but this adjustment gives us a temporary benefit. The development of the industry and the power of production are certainly natural but this "natural" must be controlled so to check the variations by means of certain applications of principles.

The methods of science and mathematics must be brought to bear on every worker's task, to make his working easier and to cut false motions and unnecessary expenditure of energy, to correct errors of judgment and adjust physical and mechanical conditions. Investigation can be carried on in any processes as winding, warping, sizing, weaving, baling etc.

Specially in mills where different counts of yarn are produced and where different counts are combined in cloth manufacture,

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it is absolutely essential to have a time study of motions of machinery working and speeds of spindles, roll speed, speed of other preparatory machineries, speed in winding, warping, weaving, pick efficiency etc. Every movement must be watched and recorded. By gradual progress the stage will come when there would be annual savings in labour much more than the amount spent away.

This is the most fruitful field for economics. To the search for wastes, energy losses and other handicaps which effect production adversely or advantageously. The study of charts, diagrams, process books, variation analysis etc reveal the secrets underlying each individual process.

The production of yarn and cloth are the results of multiplication of processes which gradually form the basis of cost and unless these multiplications are not clearly defined it is quite possible for the expenditures to be invariably calculated and added up, which may sometimes be insufficient to repay the cost of production and the sorts

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produced on such basis will not continue.

Persons whose methods of calculations are based merely in balances of nominal ledgers and the productive figures of the departments embark on a wrong boat. They may forecast profits but finally find the results just the reverse.

Whenever there is a demand for new sorts, mills go on producing same with a hope of unusual profits but never care to analyze the total demands coming in during a fixed period. The results of such production destroys extra profits and generally go beyond the mark and link the value as much too low as it had before been raised too high, until the oversupply is corrected by a total or a partial suspension, of further production. These variations require proper statistics at the source.

To recapitulate, the proper analysis and statistical datas of production, inter-distribution and sales govern the future of the industry. In all sorts there are warp and weft combinations and indefinite multiplication of processes and additions of results

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which forecast the future. These processes and results are further controlled by forces which either lessen the efficiency or increase.

To controll these and other disturbing influences thorough study is essential. Study will only lead to classification and analysis of these factors.

IV

TRAINING TOWARDS EFFICIENCY.

THE growth of scientific principles have enabled any class of industry to be managed efficiently. These principles are applied to a wide range of industrial activity, after study of internal departmental situation.

The training should be given to each man to understand his duties so that every machine can be adjusted with the greatest precision and kept in perfect working order. A regular system of cleaning and oiling must be introduced.

How does it happen, that mills in Japan and other places are continuously prospering and the country rapidly increasing the number of mills and underselling us in every way.

If dozen balance sheets of mills working in those countries are studied we find that the average profits are such to excite surprise. When it is remembered, that at the same time, others, complain of the slight margin between cotton and yarn and the consequent impossibility of realizing even bare interest on the capital invested, to say nothing of remuneration for the trouble and risk involved. It is asserted that the workers there, are good and efficient being comparatively well paid and paid on such principles as to give quite general satisfaction to both employer and employed.

These mills are entirely free from petty strikes and when any dispute arises, properly accredited officials at once take the matter in hand and settle it with almost mathematical precision by arbitration.

The employers have so trained themselves that their spindle point always have very careful attention. There the automatic looms have been brought to such great perfection that it has become profitable and possible to produce any kinds of sorts at

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an expense less than an ordinary loom.

The management must be based on such scientific principles.

There comes a time fairly soon, when attention will have to be paid to the finer points that at present escape attention. The man holding the fort around is worthy of tribute.

When, one considers all the points and the disturbing sides he finds something new. The many spurious influences that are at work are checked then. Why should we step and stumble but not care to keep our footsteps on the right line in the narrow path.

In mills the main things are to keep ahead with production and quality. By looking well after the machineries, seeing that everything is in order and by keeping the hands up to the work, we find our productions improving and qualities to our standard specification.

The quality depends upon these points, taken in conjunction, with a fair, even yarn, good sizing and efficient control of each

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individual process viz, winding, warping, sizing, drawing-in etc.

Care, supervision, analysis are the three factors that govern working. It would be useless to go on enumerating scores of things that occur daily and prevent working, or its various motions from working with precision and accuracy.

If the machineries are kept in good working order, clean, well oiled, if everything be set right and in its proper place if all and every motion is regularly recorded no sort of trouble will be heard of. Careful watch and uptodate datas tend to give the production and at the same time exact better work with less trouble and loss of human energy.

Every plant must have an adequate production data, every mixing must have an adequate and standard procedure, every individual record must be maintained for waste of every class from bale breaker to ring, reeling, winding, warping, sizing and weaving. The procedure of allocations to individual mixings must be standardized or

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a percentage fixed, every labour must have an adequate standard data showing the human energy consumed and wasted but as for weavers efficiency cards are suggested.

No doubt some of the procedures are complicated but by gradual progression these can be fixed to operate and when these operate the results become very clear. The uniformity of work is thereby assured.

Since the raising of efficiency is the first purpose and final end of upto date scientific management, it follows that the training of the labourers is the pivotal task—the hinge on which the whole plan swings.

It profits you nothing to discover or develop the one best way of doing anything and everything in your mills unless you can teach the right way to your men who put your cotton through the machines and who in each succeeding process spend their human energy.

Neither the general instructions and practical work which prepare apprentices in the ordinary departments or the breaking in of a new labour, mistry or supervisor

Training towards efficiency

to an unfamiliar job will serve here. Instead, is required the patient, individual instruction and skill of every men in the organization until he learns the best way, until he masters a right method that he can finish his work in time and until obedience to directions and mastery of the standard method has become an habit, both for the mind and the muscles.

The labour is one of the factor in production. All the efforts of the management, centre on making it possible and easy for him to perform a given operation by a prescribed method. This demands closer application, analysis, consideration and above all quicker thinking.

Our labour usually see very quickly the apparat objection from their own view point. Our pieceworkers usually see their own individual rate even though the earning increase. Their class psychology suggest too, that multiplied efficiency means loss of employment to other men in the line and this understanding is extended to each individual.

The cultivation of patience is essential,

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combined with tact and understanding of human nature. Before a principle is applied it is necessary to make important physical changes.

All the small details, inside the mills which are usually regarded as of very little importance and are left to be regulated according to the individual taste of the workman or at best of the jobbers, must be very thoroughly standardized. Such details for instance, the care of the parts, throwing of the waste, going out frequently, leaving work under pretence must not be overlooked.

It is a proved fact that more wages to the pieceworker is the greatest encouragement to industry. After we have studied all the processes, inter distribution, routine, labour efficiency and fatigue the only problem that remains is, how to induce the pieceworkers and the labourers in general, to follow instructions and do the work in a right way.

The study of relations betwixt the employer and the employee and the knowledge of what constitutes a full day's work and

fair day's pay should be analysed.

The management, must invest also in investigation. If the labourers receive benefit and are placed in a position to live in better conditions, certainly they will honestly discharge their duties quite willingly and honestly. The present trend of the labourers is different. They do not and are not taught to look upon their earnings or any portion thereof as an interest on their labour investment. They only look to pay slips that they receive on the pay day and not to its economic value.

The average worker is naturally lazy. He is found not to decrease the pace of work but to increase it. This tendency has brought the work below normal conditions. They have formed this habit because our mill friends have never cared to know what is full day's work. They have handed themselves, to increase wages arbitrarily and employers seeking to increase production and decrease unit cost have devised half way measures based on personal judgement.

It does not mean that the present wages

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system do not work. Depending upon the employer's personality, his ability to gauge work and men-piecework, bonus and prize methods of payment as stated above work more or less successfully in individual cases, the difficulties that have arisen with monthly work, day work and piecework with bonus prize etc come primarily from a lack of judgement on the part of the employer and worker of just what constitutes a full day's work and fair pay.

We may take the present piecework system and pay. By experience and judgement, a piece rate is set which is fair to mill owners and workers but there have been instances when often either know it. If the worker is satisfied the mill owner is fearful that he is not getting all he might out of the work. On the other side, the worker knowing this holds back with a fear that the rate will be cut if he accomplishes all he can.

There are mills who have set in bonus system, while there are some mills where worker is paid extra according to an in-

creased percentage of production.

The system of profit sharing is not to be found in India as a direct incentive to increase production. Experience in this direction proves that its benefits are weakened because the reward of increased effort is too far distant.

We are not concerned with chances but we have to establish procedure on the basis of facts and figures. The basis as such, are obtained by unit studies and detailed analysis.

Before committing to anything it is advisable to try and test it. You should see that in increasing wages if there is increase in production and decreases in costs then see the facts from a new angle. Higher wages mean reduced costs only when production is increased more than enough to cover the increased cost. We are interested mostly in actual results and it will always pay to make a careful study of methods on scientific principles. Science can be applied to labour, time and production and often mean the difference between success and failure.

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There are secrets underlying science. If you bear in mind that at the base of every principle there is something of interest, some fact, the very searching for this, helps to reveal the secrets.

This secret is the cause, underlying.

We make new systems but that will not check our working until we lift our men by giving them understandings. When our men understand the real state of things, our work then becomes easy and we are tempted to do something good further for our men and our industry.

V

WEALTH IN ANALYSIS OF TEXTILE PROCESSES. THE ONLY WAY OF SOUND ORGANIZATION.

IF we wish to master our internal development, efficiency and detect visible and invisible loss, we must build up a standard and then maintain it. In most phases of our industrial existence, two tendencies are always felt, on the other hand, influences are at work, to degrade or destroy, on the other we may get into contact with that which encourages our efficiency. We have already noticed some of the tendencies in our previous chapters.

Building up our internal systems, with a careful watch on variations enable us to detect invisible losses. A best man with sound knowledge of techniques can traverse

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more than a small part of it but the earnest will always seek to trace the movements of inter-processes, its units of production, inter connections and combinations. Such a pursuit in itself increases knowledge and heightens the enjoyment in work.

There is not a single book which deals with subject on particularly economic aspects of an industry and the important part that the science acts in it. If we meet that vital and fascinating elements composed in analysis of process facts and figures we find the following important essentials.

- (1) *Accuracy.* By this, I mean the detection of improper distribution shortage and excess, leakages and variations in wastes, improper and inaccurate allocations.
- (2) *Correctness.* This involves correct manipulation of mixings. Those who construct and compound mixings do not know how to keep this in check. They simply apply mathematical tables to it and find out results.
- (3) *Suitability.* No surety of parity bet-

ween cotton and waste is known and experiments are usually made for this. Suitability and similarity must be found out.

In many cases it is found that constructions and compounding is not properly done which causes every result to variate. The course therefore should be chalked out.

The practice of analysing facts and figures, will however, do much good than can be theoretically expected. Science refines the facts and discloses the figures that lie jumbled up to enable the industry to be well dressed externally and purified internally.

There are various matters that are scattered up and very little care of such matter lead us to experience heavy loss in long run. Experience teaches us that analysis of processes, discloses the secrets and stops errors, misadjustments etc.

Our study should not be in a superficial way. We must touch the essence and then draw out boundary lines with a centre where all lines should meet. This centre is what we should call statistics. These will control

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all the operations from one end to the other.

The internal variations that make achievements and profits impossible must be chrystalized by analytical procedures.

Experimenting is risky. Success depends upon ability and directing an entire organization is not so much a matter of unusual genius as it is of trained and well directed intelligence, concentrated effort, courage and hard work.

What is wanted for immediate guidance is beneficent principles of action, to which superior minds forming and an aristocracy in industrial affairs, may swear allegiance and which they may carry forth to establish realities of facts and figures.

Our industrialists should understand that on them, rest a sort of trusteeship to preserve the property entrusted to them and a demand of leadership to guide and guard their employees. Upon them also, rest a general responsibility to the public to help this day to live its life and this generation to make its contribution to progress.

In view of the above fact it is necessary

to commence the inauguration of an internal efficiency systems, whether in a professional capacity or in the direct employ of the shareholders on behalf of other partners. The ultimate success depends upon the care with which the relations personal and practical are studied. The analysis of the symptoms, complaints, disorders and waste will point out the determined results.

Management however, by hired persons who have no interest in the results but that of preserving their salaries are proverbially inefficient, unless they act under the inspecting eye, if not the controlling hand, of the persons interested and prudence almost always recommends giving to a manager, not thus controlled a remuneration partly dependent on the profits in the shape of bonus. The officers then will aim at producing a congenial spirit amongst other subordinate staff who will in turn create the same pleasing atmosphere all around.

We do not mean to imply for one moment that these things cover all, that you can do. The practice of these with analysis

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of various factors, will, however make much more than expected. Other factors will come to your notice and tempt you to analyse these too. Cloth requires a good many touches before it is finished and these touches involve many complications.

Any one acquainted with the textile industry is aware that there are no suggested lines of internal organization of textile mills.

As at present the position stands, we find that each mill have their own chosen system. The increasing competition and changed conditions of manufacturing have brought the subject of internal organization very much to the front during recent years.

It is unfortunate that this has received so little attention at the hands of manufacturers and that the class of man in charge of internal process account, is not of a better calibre. The fact of the matter, is, that our mill owners are in the main very conservative and when they find business paying, they do not feel inclined to spend either time or money on new methods, some of even do not care to understand.

Wealth in analysis of textile processes

To a certain extent the accountant is not without blame, inasmuch as he, in many cases, does not consider, the process accounts as within his sphere.

With increasing competition and improved methods of manufacturing, a more accurate record of detailed process accounts and inter analysis of distribution of each individual process unit and waste relating thereto, becomes increasingly necessary and it is hoped that mill owners will in time learn that the men who can show them how profits are made or how saving can be effected, are equally valuable with their better paid colleagues on the other side.

Among the many forces at work in present textile industrial development, perhaps the newest and most striking is the movement for internal organization and development.

This movement is based on scientific laws and therefore it is sure to succeed. It would not be correct to maintain cost accounts without having a proper and upto date internal link betwixt processes. The fixing of the selling price without accurate internal

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progressive, data, is erroneous. A detailed survey is absolutely necessary in order to check increases, wastage and to ascertain where savings may possibly be effected.

The idea underlying the process analysis is the simplification and accuracy in costing of various textile sorts and different yarn counts and where particular process unit is sold there to find its cost. Actual cost of waste is also dependent on this data.

The elaboration of books, rulings and forms must be left to an expert or to such person who is fully acquainted with the internal technical processes and its intricate accounting. Figures thus obtained will be subject to continual comparison and review, the resultant percentages being looked upon more as minimum than otherwise, the tendency being to work to a finer figure every year and the attainment of this being sought principally in the manufacturing account, hence the great importance of process accounts and the urgent necessity of having in every mill a proper record of each process, is essential to keep the mills always in balance.

Wealth in analysis of textile processes

The marvels of science enables us to view our internal working, external and internal influences at work, the markets of the world, all from the desk.

There are concerns that speak of manufacturing profits but they do not quite understand the accuracy of the phrase.

The sole tests of the profitableness of a mill is the progressiveness of the uniformity in profits; if this fail, it is for the progressive process accounts to find out the error and the cause of the variation or to point out the qualities that do not pay. The method of applying costing results to sorts in finding out the total return is sometimes misleading as costing of sorts is done on the quantity warp and weft in use and all calculations are based on the weight of each count nett but no variations are taken into consideration.

To avoid inaccurate results, it may be described that a systematic and an accurate record of all inter transactions is absolutely essential for arriving at the actual facts both direct and indirect, of the individual process output. The results shown by the pro-

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cess accounts should be brought to as near an agreement as possibly with the financial records.

When a perfect system has been brought into existence, the results shown by previous mixing manipulation can be used as a guide in future mixing adjustment. Rough and ready methods are still, however the more usual, although as the advantages of a scientific and accurate system become better known, this particular branch of accounting will gradually be improved.

In introducing a system, it is wise, as a rule to proceed slowly at first and to extend the system according to the necessity of the particular process. It is easy to adopt a simple system to peculiar circumstances than a complicated one, hence the advantage of proceeding with caution at the outset.

In order to arrive at the most useful and satisfactory result with the minimum of labour and expense, great care must be exercised in deciding what shall be recorded in total and what in detail and since statistical procedures have been introduced, de-

tailed history of each individual process and changes thereon stage by stage, variations in productive and waste percentages are easily known. This is a very good idea in statistics.

It is not possible to dispell a good idea by mere rule of thumb collections and to take it for granted that the system being complicated would act just in reverse direction. This sort of mental rejection and accepting a self made idea, plunges the capitalist into difficulties and thus persuading him to abandon all the better chances and forcing him to embrace the precarious and doubtful course which rightly is condemned.

The feeling of any doubt is the object of general dislike and dereliction and a person so subjected is fit to be sympathized. Such is the course of degradation and destruction.

The routine and the procedure of work is not determined by its own needs, but by the needs of the textile mill, its intrinsic position and the needs of the owners.

For instance, with most other clerical departments the work is arranged according

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to the calender and certain days are fixed for certain work, whereas the procedure of process statistics and analysis cannot be planned in this way, as the work is regular process to process hence the work should be based either on fortnightly or monthly basis, when all information should be collected and arranged mixing wise and also process wise.

In matter of wages, analysis should be done fortnightly but where monthly system of payment is made, there, figures should be totalled at the end of the month. It will be seen that whilst a certain amount of routine can be planned in conjunction with the calender, there will be many important functions which can only be performed as when process is completed. For instance, bundling, baling, folding, calendaring etc, but inter process stocks can be ascertained previously.

The general arrangement and lay out of a process accounting department and the procedure in regard to statistical records cannot be dealt with, in any great detail, in work or on scientific management but the author will deal in his separate book on

textile costs and process Accounting.

The principles of accounting should be extended to processes from mixing manipulation to spinning production and from winding to weaving. The author will be pleased to submit suitable rulings to suit the readers requirements.

The internal activities of the mill should be sectionalized so that abstracts of process outputs can be easily and correctly prepared by the departmental clerks. The head of all such individual sections—is the main statistical department who is entrusted with the preparation of monthly process analysis and final aggregate monthly reports to enable costing to be done.

In the same way the time office department should be organized, so that, monthly statistics of labour employed by each department can be had for the monthly abstracts.

The monthly paid men and those on piecework should be separately taken.

It is then with the cost department to analyze the wages but human factors, are concerned with processes hence the best

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suggestion is to introduce a system whereby the analysis could be further extended and attached with each individual process and the sum of all to tally with the cost department analysis.

It is equally important, that attention should be diverted to each machine from Blowroom to spinning and from winding to weaving as the good performance and the duration of machineries, depend to a very great extent upon correcting every shake or imperfection in their parts, adjustments in gearing and a system should be introduced so that each man is obliged to attend to it on spot to reduce the expenditure arising from the wear and tear of the machinery.

Not only this, every detail arising out of the work should be noted and every mill agent should provide diaries, with printed questions on every matter connected with the essential factors on each machine in the mill so that all changes in process and in the machine may be recorded. The separate time sheet should be provided to

enable records of time taken in piece up and doffing, etc.

There are innumerable details which are required such as speeds, drafts, settings, humidity etc which all require very careful attention and the diary should be so arranged that all the necessary details are taken in and then grouped up according to the departments and finally analysed.

Considerable economies could be effected if these factors alone are attended to, with more care than at present and this to certain extent explains the great difference often met with, in regard to working costs in a mill, production and work with the inferior mixings.

We have to choose the best way and the shortest cut. Our growing tendency will not prevent us from bringing to ourselves greater benefit and efficiency. We have to work with determination and no interference should be in our way to enable us to have order and method and our directions in a very right way, to train ourselves to admire ignorance and weakness

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and thus to bring the whole working to perfection.

We have therefore to learn by experiments, from our statistics of departmental processes, from our diary, from our labour analysis, from our seasonal variations in productions and finally apply the results not only to check the intrinsic variations in cost but also materials, its quality, its strength and production.

The likelihood of securing an increase of productivity in the future depends mainly upon, application of science in securing of an increased reward, in the development of costing and in development of efficiency systems. This will also show us our weak points.

It is not to be denied that the present age requires certain things in changed condition. History bears witness that no industry can develop without concentration of effort, without scientific laws to control such concentration and no progress can be expected without compartments.

The general contention is that, unless

capitalists develop these faculties, full, rich and independent industries cannot be had.

The modern textile industry, when based on such economic ideals, turns to be, the concentrated and directing instrument of economic prosperity of our country.

We have previously dealt with organization and its importance to our great industry, its working and its effect on the return, when sorts or different counts of yarn are produced by different labour, either in the making or finishing. These things virtually or actually, to some extent effect the cost and the efficiency.

By improper check and visible loss in waste or invisible loss in labour, the actual loss is greater then ever expected or than the profit and loss account figures. The figures shown by the profit and loss account cannot be called as absolutely correct, only because, the invisible loss, the loss due to seasonal variations are not defined, neither when, cost calculations are made, these factors are then taken into consideration.

There are innumerable variations intern-

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ally, viz variation in inter distribution, variation in result of processes, variation in waste, in cuts produced which all are mathematically adjusted to arrive at a result on the whole but are never analysed separately hence the result arrived at by the former method can never represent the true and actual position.

Apart from the general considerations examined hitherto, there are other reasons too, which render imperative a change in system and policy.

No sounder policy can be laid down than that maintained by the conomists, namely, good management is the foundation of sound industrial structure. It is only bad management that ruins the structure and therefore the public conscience unanimously demands that our industries should come into line with progressive modern ideas to enable a higher return on the investments.

From the above fact, we conclude that improper organization has a detrimental effect on industry and is always destructive in its effects.

This is why we are always to bring to an end all malpractices and substitute a system based on scientific principles for the betterment of our industry to enable us to have a weapon with a cutting edge to turn against factors that lead us to loss, that stop our efficiency progress and that keeps our productive capacity low.

The effect of well laid plan upon our industry must be to increase the production and reduce costs. This is indeed admitted by well experience practical textile statisticians and cost experts who assert that actual survey, would lead to sure building of the internal structure. If the structure is unsound the possibility of smuggling is always there, errors always lie concealed, fraud always playing part secretly.

Important as this organization is, as a means of simplifying our internal system and making it more just. It is safe to say that the energy and zeal devoted to its advocacy have been evoked mainly by the belief that it is a great means of industrial reform. The more clearly we realize that

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the processes touch us at almost every turn of our industrial life, the more certain it appears that a radical change of our system must produce great changes in our working and inter relations. Those to whom the changes are unwelcome suffer the consequences.

The Japanese system of working, the American system of management are prima facie evidences. They have attempted to solve the problem and could by these means create monopolies in other markets by lowering their cost of production by double shift working, by introduction of automatic devices in spinning and weaving and by co-operating with labour.

By introduction of principles of internal control the costs have been further reduced. In view of this, let the skilful hand control the internal working, variations and manipulations and just see the result.

Many amongst us, do not value the internal constitutions and like to stay behind.

There are arts in figures, science in directions but to find out cause and effect

Wealth in analysis of textile processes

is tedious; what we seek is success without regard to the word "tedious."

We can point to such capitalists in our country of indespicable importance, to the carrying on of Managing Agencies, whom we could ill spare. Any one of them would be our loss. But they also spoil.

They never try conclusions. They are far from reach by the subordinates who know the technicalities that are worth because of the responsibilities attached to the practical working.

For profitable working of an industry, not only, has the process manipulations and physical changes of cotton to be considered but also the customs, systems and operation methods, their economic ideas and the influences that have gone to make them and the finished products.

The management contains many other important elements. It is the one most permeated by the influences of those processes of physical changes in the raw material which calls for gradual and progressive analysis. For the establishment of

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this sound guiding principle the claims of merit and fidelity must become predominant.

The small and insignificant factors which tend to create factions should be stopped and standard of responsibilities should be imposed on each head so that they may try to attain that standard and give efficiency higher to make the production remunerative to all viz, employer, employee and share holders.

Unless these are not analysed, due allowance cannot be made for various inequalities, difference in weights betwixt one process and the other, natural visible and invisible losses, loss in labour efficiency due to fatigue, loss due to improper parity in progression as well as the rate of such differences nor the equation could be fixed.

There are so many irregularities that creep in and in face of these facts, it is impossible to obtain general theorems embracing the complications of circumstances which tend to effect process results.

VI

USEFUL HINTS.

TO gain efficiency, personal efficiency is absolutely necessary. Always be alert to prevent faults, rather than to check them after they have occurred.

Check productions regularly and note time lost.

Compare hank produced with calculated hanks.

Test always pounds produced and wages paid for.

Test weights regularly.

Check speeds of front rollers. Compare calculated production with the actual and strike the variation.

Keep records of speeds in spinning room.

Whatever instruction you pass to the jobbers, note down in your diaries

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and take the signature so as to make him responsible.

Use your diaries for building purposes and not to mix in the heap.

Check wastes and calculate the percentages always mixing wise, Check the distribution of waste and compare the stocks.

Introduce monthly system of process stock taking. Divide stocks in groups of mixing and machine wise.

Have monthly consumption charts for stores.

Compare your process results with the cost basis.

Compare your distribution with the receipts of the next department and strike the variations.

Have every indicator tested and corrected.

Maintain a regular and uniform speed.

Always strike out the difference betwixt actual mixings and the productions at Roving or difference between mixings and laps, laps sent in for carding and productions in

Useful Hints

slubbing and inter, Inter and roving, roving and ring or mule.

The productions from one process must agree with the production plus waste of the other process. If there is any difference than the same must agree with the stocks. Try such agreement every month and strike the variations.

Same procedure for every department.

Always check heavy and light in sizing.

Always check difference betwixt the actual production and standard productions in weaving.

Adjust always faulty methods of handling beams, shuttles, improper use of reed hooks in weaving.

Maintain Group results in weaving.

Distribute work to jobbers and change them from one line to the other.

There is something in the change.

Maintain records of sorts loom wise or according to reed space or pick wise. The best method is to group according to mixings and warp counts. Test efficiency and production.

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Keep an eye on stores consumed and see which line wastes.

Have a proper and efficient check on cut lookers.

Have an abstract of light and heavy pieces, bales and finally find out the loss invisible and the amount you give away to buyers in cloth.

Try to observe men and things and form an idea, which then, apply to profitable use.

Mental efficiency is the foundation of all efficiency.

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